IMPACT Center
WASHINGTON STATE UNIVERSITY

2022 WASHINGTON STATE POTATO CONTRIBUTIONS:

ECONOMIC ACTIVITY and PRODUCTION CONSTRAINTS

A report by Washington State University's IMPACT Center

Washington Potato Economic Contribution Statement

Timothy P. Nadreau, Ph.D.
Assistant Research Professor

Impact Center
School of Economic Sciences
Washington State University
Pullman, WA 99164

Contents

1. Introduction and Background

2022 was the first year since the COVID-19 outbreak that potato producers were able to return to semi-normal conditions. We say semi-normal because acres, yields, and production are still low relative to the pre-COVID decade, but prices increased to approximately $9.24/cwt. This price recovery has largely caused sales figures to recover. Nonetheless, production costs have risen as well, leading to reductions in both gross margins and net returns for potato producers. From 2019 to 2022 estimated revenues per acre have gone from $5,512.50 to $5,197.5 respectively. This 5.7% reduction in revenue-generation was coupled with a 16.4% increase in costs. While growers were able to cover their variable costs of production, they were largely unable to recover their fixed and management costs during the 2022 season.

The purpose of this report is to incorporate the current state of potato production in Washington and identify the role that production plays in the potato value chain for the state economy. We adjust our economic model to account for the changing expenditure patterns of producers, as well as using the most recent economic transaction data in the state to determine the portion of the states GDP, Income, and Employment that rely on potato production. We capture the forward links in the potato value chain and the added returns to the state from the value-added processing that takes place because of Lamb Weston, Simplot, McCain foods, and other potato processors in the state. While our focus here is on the economic role potatoes play in the state, and more broadly in the nation, the reality is that the forward links in the value chain, particularly the processors and transportation elements, largely exist and provide employment within the state because of the growers. The nature of the good is such that processors locate close to the production, rather than the demand centers.[1]

We include a brief discussion on the tax receipts collected by state and local governments. There is growing discussion regarding agricultural deductions and exemptions. However, these discussions rarely account for the indirect taxes generated in the state as a result of the new monies brought into the state from agricultural exports. Accounting for these new monies and the associated taxes serves to deepen the discussion and provide perspective regarding the true contributions of the agricultural sectors to the public coffers.

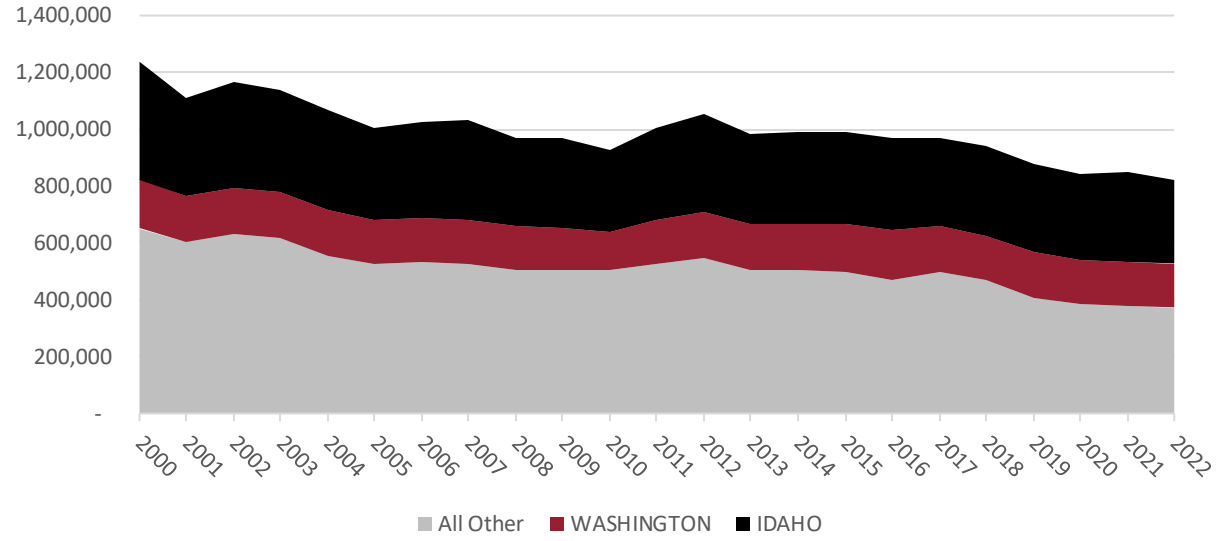
Lastly, we address the real changes in the value of potatoes to the state over the past several years. We normalize the methodology across past studies and report all financial metrics in 2023 base year dollars. Typically, we discourage comparison of impact results over time as the economy is dynamic and it is not clear to what extent the change reflects policy, farm practices, demand for processed goods, etc. These comparisons often lead to flawed assumptions about cause and effect. A more in-depth regression analysis would be needed to determine which factors "caused" the fluctuations in economic activity. Such a study is beyond the scope of this report. The costs of such comparisons traditionally outweigh the benefits. In this case a methodological change in Input-Output modeling, necessitates such a comparison. The benefits of comparing the real change in contributions shows that even in a mature industry, such as potato production and processing, gains in value can still be achieved. Economists refer to increases in value, development.

[1] This is juxtaposed with Washington wheat, which is largely exported to Asia before processing.

2. National and State Potato Perspective

Only 13 states in the U.S. reported producing potatoes in 2022. Of those only Idaho and Washington harvested more than 100,000 acres, Idaho at 294,500 and Washington at 159,500. The next closest producing state was North Dakota at 73,000 acres. Washington and Idaho combined represent half of the total potato acreage in the nation. This is predominantly why the major chip and fry processors are in the Pacific Northwest. Washington saw almost no change in acreage over the past three years. While the state is down 11.7% since the start of the 2000's, Idaho is down 28.7%. Not only is Washington preforming better than the industry as a whole, but their volatility is also low relative to every other state. Figure 2.1 shows the trends in potato acreage for Washington, Idaho, and the U.S. as a whole. These trends suggest that Washington is winning a war of attrition.

Figure 2.1: *Idaho, Washington, and U.S. Potato Acreage from 2000-2022*



Source: USDA NASS Quick Stats (2022).

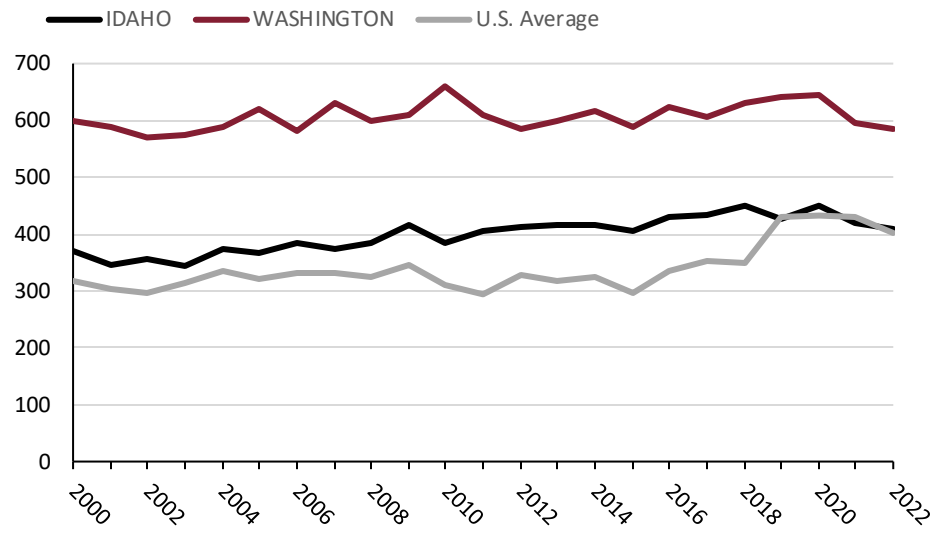
Washington, once again, had some the highest yields in the nation. This resulted in Washington having roughly half of Idaho's acreage yet producing 75% of their output. Table 2.1 shows the 2022 estimates of harvested acres, yields, and production values. Figure 2.2 shows the historic yields from 2000 through 2022 and illustrates just how much more efficient Washington is relative to Idaho, and the Nation, in terms of output per acre.

Table 2.1: *Selected 2022 Potato Production Data*

Region	Acres	Yields (cwt/acre)	Sales
Idaho	294,500	410	$1,091,784,681
Washington	159,500	585	$817,244,846
United States	***895,600***	***401***	***$3,662,940,688***

Source: USDA NASS Quick Stats (2022).

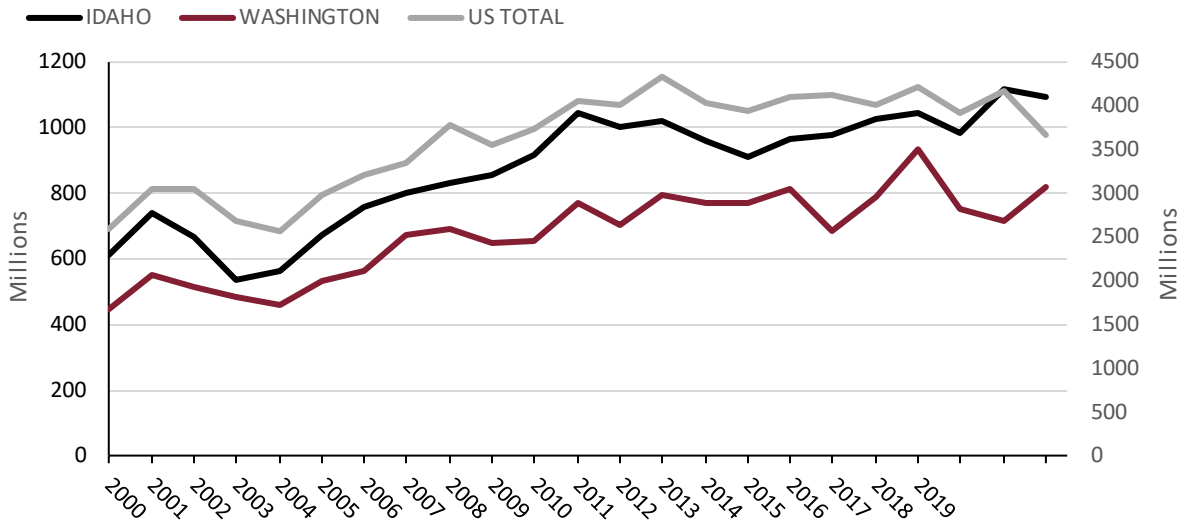
Figure 2.2 *Idaho, Washington, and U.S. Yields (cwt/acre) from 2000-2022*



Source: USDA NASS Quick Stats (2022).

Figure 2.3 shows the production value over time for Idaho and Washington on the primary vertical axis and for the nation on the secondary vertical axis. Idaho outpaces Washington in value due to their scale rather than their efficiency, but that gap may be closing.

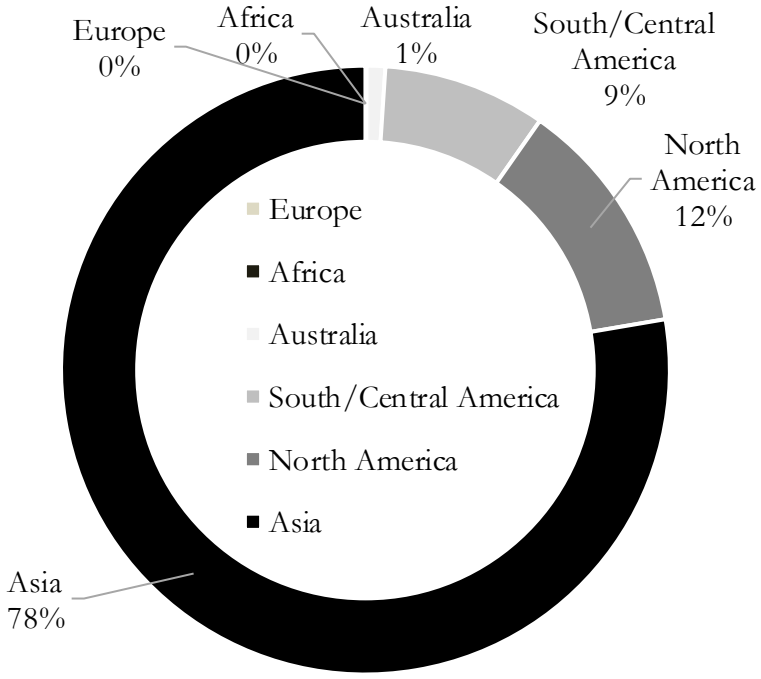
Figure 2.3 *Idaho, Washington, and U.S. Production Value from 2000-2019 (Millions)*



Source: USDA NASS Quick Stats (2020).

Of Washington States potato production between 80%-90% is processed while the remainder is sold as table varieties, seed, or feed. Nearly all of Washington's potato output is consumed out of state. Figure 2.4 shows where Washington potatoes are consumed as measured by the Harmonized Schedule destination data.

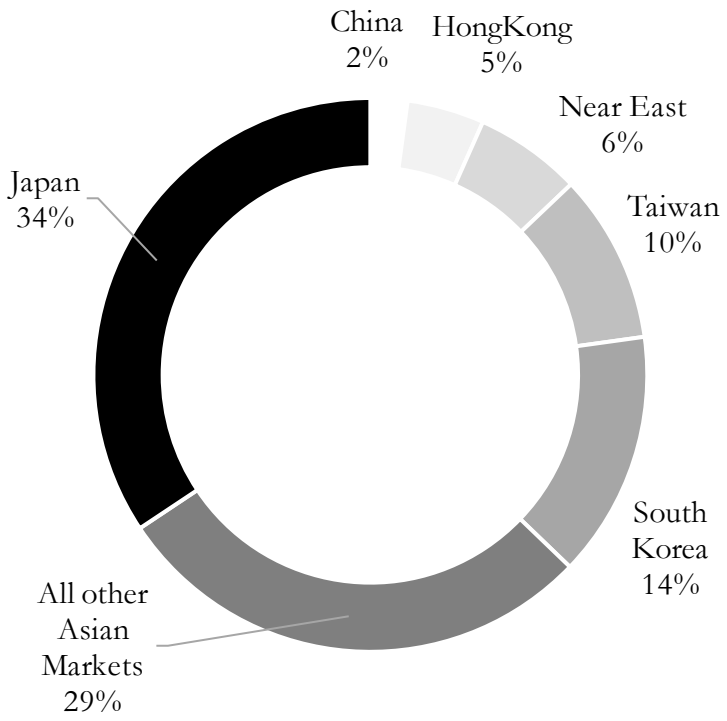
Figure 2.4: *Washington Potato Products by Destination*



Source: U.S.- Census Trade Online

The large demand in Asia is reflective of the population demand, transportation network efficiencies, and incomes. These three factors combine to make Asia an ideal market for all Washington agricultural goods and potatoes are no exception. Figure 2.5 shows the dependency of our Asian exports on specific regions and nations.

Figure 2.5: *Washington Potato Product Exports by Asian Market*



Source: U.S.- Census Trade Online

While most Washington products rely on China as a primary export, Potatoes lean heavily on Japan, South Korea, and Taiwan. This is not solely due to the "McDonald's Effect" either. China has 3,500 McDonald's restaurant locations while Japan has 2,900. We are looking further into the causes for the departure potatoes exhibit relative to other Washington agricultural products.

What remans clear is that these Asian markets are struggling demographically and may not represent a long run stable market for Washington Potatoes. Further details regarding demographic shifts in Asia and their relationship to Washington agriculture may be found in the macroeconomic article of the 2023 edition of the *Washington Agriculture: Status and Outlook* report on the WSU IMPACT Center Website.[2]

[2] http://ses.wsu.edu/impact-center/

3. Contributions of the Potato Value Chain

Potato production expenditures (e.g., fertilizers, soil testing, planting, etc.) for the potato crop harvested in 2022 were made in late 2021. Thus, the impacts stemming from the 2022 potato crop had already occurred, but the income to farmers from that crop had not. Farms typically put their harvest in inventory and sell it to processors and retailers through to the following year's harvest. Potato production by utilization data for the 2022 season indicates that the numbers have changed little since 2021. USDA reported in their 2022 mid-year release that nationally 25% of potatoes went to table stock, 70% went to processing, and 5% were sold as seed. Those numbers differ for Washington where only 10.5% are produced for fresh pack and 89.5% go into some form of processing. Measuring contributions means looking at the supply chain for the growers and the processors and measuring how those monies flow through the economy. This process requires careful attention to avoid double counting, while still capturing all appropriate transactions and supply chain dependencies.

2022 Washington Potato Income

Converting Enterprise Budgets to Input-Output Vectors

Whether quality or availability issues arise, what is abundantly clear is that the 2022 Washington harvest had returned largely to normal levels of revenue. The impacts associated with potato production require us to use the farm enterprise budgets for potatoes to begin tracing the expenditures of the farms through the state's economy. This section of the report discusses the basic methodology used to convert average farm spending on potato production into input-output vectors that can be used to trace those monies through the economy before they leak out of the state in the form of import purchases. These budgets were based on 2022 figures developed with growers in late December. Basic spending patterns were similar to previous years, but with steep price increases for chemicals and fertilizers, fuels, and labor.[3] Table 3.1 shows the 2022 revenues and expenditures for total potato production in Washington.[4]

Following the methodology of Willis and Holland (1995) The enterprise data is mapped to IMPLAN industry accounts according to the mapping in column three of Table 4.1. For example, potato seed is mapped to IMPLAN Sector 3 (vegetable and melon farming). Another example is fungicide and insecticide, where 80% of the expenditure is mapped to IMPLAN Sector 167 (pesticide and other agricultural chemical manufacturing) and the remainder is mapped to IMPLAN Sector 19 (support activities for agriculture and forestry).

There are three major steps in converting the expenditures in the crop enterprise budget into input-output accounts after the dollars are allocated to IMPLAN sectors. First, we margin the constructed input-output accounts to convert from consumer prices into producer prices. Margining is a process of splitting the cost of an item into four primary components that make up purchaser prices: *retail margin*, the portion of the total cost (TC) that the retailer keeps to operate

[3] We are not assuming any large technological changes have occurred since the 2018 budgets were prepared.
[4] Note that there are many different types of production and contracts So these budgets do not reflect specific farms and are only used a representative expenditures patterns for the state at large.

their store, and pay their workers, taxes, and other expenses; *wholesale margin*, portion of TC that the wholesaler keeps for operational expenses; *transportation margin*, portion of TC charged by various forms of transport (air, rail, water, and/or truck) to move products along the supply chain; and *cost of production*, the product's value when it leaves the manufacturer/factory (IMPLAN Group, 2019). For example, looking at the purchase cost for fertilizers, we use the margins built in IMPLAN to split the fertilizer cost into retail, wholesale, transportation, and cost to manufacture fertilizer. We also use the adjusted margins in IMPLAN, which account for locally produced inputs.

Second, the margined industry account is allocated into the appropriate sector in IMPLAN; and third, the industry accounts are scaled to the state level. This last step is done since the crop enterprise budget is originally presented in a per-acre basis. Values are multiplied by the total potato acreage in Washington State to scale up the margined industry accounts to the state level. Table 4.2 shows the input-output vector used in our state potato model. Using the previous example, the fertilizer cost Table 4.1 has been margined and allocated to four IMPLAN sectors in Table 4.2 — Fertilizer manufacturing, Wholesale (Other nondurable goods merchandise), Wholesale (Wholesale electronic markets), Retail (Building material and garden equipment), and Rail transportation.

Table 3.1: *Potato enterprise budgets with IMPLAN Mapping*

Category	Total ($)	IMPLAN Sector
Gross Income	$933,281,250	
Variable Costs		
Tillage	$16,500,000	19
Planting	$18,150,000	19
Seed	$87,450,000	3
Fertilizer	$140,250,000	167 (0.8), 19 (0.2)
Fumigation	$62,700,000	170 (0.8), 19 (0.2)
Fungicide and insecticide	$69,300,000	170 (0.8), 19 (0.2)
Herbicide	$12,705,000	170 (0.8), 19 (0.2)
Irrigation water and power	$22,687,500	49
Irrigation repairs - center pivot	$4,125,000	515
Irrigation labor	$13,612,500	Labor
Digging (harvest)	$44,240,625	19
Hauling (harvest)	$42,900,000	19
Cleaning and piling (harvest)	$40,218,750	19
Storage	$124,740,000	422
Monitoring	$4,620,000	19
Interest on operating capital	$35,210,175	441
Total Variable Costs	$739,409,550	
Fixed Costs		
Management, administration and overhead	$28,875,000	Owner (0.5), 19 (0.5)
Regulatory compliance	$4,125,000	455
Land rent	$140,250,000	447
Interest on fixed cost	$8,662,500	441
Total Fixed Costs	$181,912,500	
Total Cost	**$921,322,050**	
Income over all costs	**$11,959,200**	

Source: Galinato and Wohleb (2019).

Table 3.2: *Input-Output Vector*

IMPLAN Sector Number	IMPLAN Sector Description	State Aggregation ($)
3	Vegetable and melon farming	49,424,252
19	Support activities for agriculture and forestry	238,057,875
49	Water, sewage, and other systems	22,687,500
167	Fertilizer manufacturing	55,632,960
170	Pesticide and other agricultural chemical manufacturing	58,263,978
398	Wholesale - Grocery and related product wholesalers	14,530,255
400	Wholesale - Other nondurable goods merchandise	43,235,531
401	Wholesale - Wholesale electronic markets	3,382,164
405	Retail-Building material and garden equipment	64,084,776
406	Retail - food and beverage stores	19,942,670
414	Air transportation	404,458
415	Rail transportation	1,981,427
416	Water transportation	78,098
417	Truck transportation	4,453,431
422	Warehousing and storage	124,740,000
441	Monetary authorities and depositary credit intermediation	43,872,675
447	Other real estate	140,250,000
455	Legal services	4,125,000
515	Commercial and industrial machinery and equipment repair and maintenance	4,125,000
	Value Added	
5001	Employee compensation	13,612,500
6001	Proprietary income	26,396,700
7001	Other property type income	0
8001	Indirect business taxes	0
Total		**933,281,250**

Source: WSU IMPACT.

This vector also represents the primary backward links in the production supply chain. The forward links in the process can be found by analyzing the grower's revenue stream. Primary potato buyers are outlined in Table 3.3. The single largest buyer is the processing sector, followed by households that capture the retail margins. It looks as though full and limited-service restaurants buy nothing from the growers, but that is because they show up as primary buyers from the processing sector.

Table 3.3: *Potato Revenues by source and value*

Industry	Value
Frozen vegetable manufacturing	$398,028,555
Foreign Trade	$85,307,774
Households 100-150k	$60,283,951
Households 70-100k	$49,708,412
Households 200k+	$38,821,758
Households 50-70k	$35,670,764
Households 150-200k	$27,872,515
Households 15-30k	$21,133,560
Households 30-40k	$19,546,401
Potatoes	$19,430,684
Households 40-50k	$17,161,993
Households LT15k	$12,713,874
All other food manufacturing	$10,582,252
Fruit farming	$4,619,238
Dehydrated food products manufacturing	$4,318,333
Full-service restaurants	$2,556,917
Limited-service restaurants	$1,992,109
State/Local Govt Education	$1,897,915
All other buyers	$121,634,245
Total Revenues	**$933,281,250**

Source: IMPLAN and WSU IMPACT.

2022 Production Impacts

Typically, we only shock exports, but raw potatoes do not typically get exported from Washington; rather, they get sent to processors. To account for this, we create a mixed model as per Steinback (2004). This allows us to sever the link between the potato growers and processors by forcing all potato product to be exported. Processors are assumed to buy all their potato inputs from outside the state. This seems like an odd assumption, but it allows us to shock potato production rather than exports while still shocking the exports of the processors, as will be addressed in the next chapter

Impact results are broken down into three categories: **direct** – the primary change in final demand for an industry under analysis; **indirect** – the business-to-business transactions that stem from the direct effects; and **induced** – the household-to-business transactions that stem from the owners and employees of the primary industries under analysis. See Appendix 1 for an illustration of how the economic contribution of the potato industry spreads through the economy as a result of direct transactions.

Basic vs. Non-Basic Impacts: Which Industry Supports the Economy?
A small agricultural town may seem to have a large medical industry in terms of employment, while the number of farm employment is fairly low, and often seasonal. However, the farms are exporting their product and bringing money into the economy. The doctor's offices are predominantly serving the residents. In this story, it is the farmers that are supporting the economy and the doctors are retaining the money within the economy. However, it should be clear that the farms would continue to exist in the absence of the doctor's offices, while the doctor's offices would not be likely to stay in the absence of the farms. In this setting, the non-basic medical jobs rely on the basic agricultural jobs. The employment impacts, including many of the doctors and nurses, would be attributed to the non-basic agricultural industries.

This story gets more complex in the case of apples, potatoes, etc. where processing occurs near the primary commodity input. We structure these models to show the interdependency of the grower and processor and assume the grow operation is dominate basic force. This is similar to coal mining or fishing operations where processing is forced to locate where the source of the commodity is located.

The direct effects are effects related to the production and processing of potatoes. The indirect effects are driven primarily from the spending of the potato and corn growers on their vendors. This includes purchases from themselves. Potato growers buy seed from other potato growers. So intra-industry purchases are captured within the indirect effects. But this also captures the spending of the vendors on their vendors etc. until the money leaks out of the state for the purchase of imports.

Sales vs. value-added
A way to explain why sales overstates impacts is to imagine individuals spending money in a regional economy. Suppose an individual spends $40,000 on a new truck. Another individual spends the same amount on an appendectomy at the regional hospital. From a sales perspective, the impacts are the same, $40,000. However, from a value-added perspective the purchase of the truck provides less to the regional economy. Perhaps $30,000 of the truck purchase had to immediately go to the manufacturer back in Detroit or Japan. Conversely, the appendectomy at the hospital probably saw most of the spending stay local as income to the doctors, nurses and hospital staff. Perhaps only $10,000 leaves the region for importing of capital assets like the hospital bed, scalpels, etc. From a value-added perspective, the hospital is more valuable than the auto dealership even though they are equivalent from a sales perspective.

The induced effects stem from the wages and salaries of the growers and their farm hands when they spend money at local restaurants, retailers, grocery stores, etc. As the income of the growers and their employees shrink so do their expenditures and the induced effects that stem from those losses in income.

Table 3.4: *Contributions from Potato Production by Type of Impact.*

Economic Effect	Sales	Value Added	Income	Jobs
Direct	$876,903,720	$453,740,661	$431,148,417	6,711
Indirect	$435,431,263	$256,763,367	$180,149,383	2,949
Induced	$521,268,710	$327,606,236	$174,502,365	2,476
Total	$1,833,603,693	$1,038,110,265	$785,800,166	12,135

Source: IMPLAN and WSU IMPACT.

Table 3.5: *Contributions of Potato Production by Industry*

Industries	Sales	Value Added	Income	Jobs
Potatoes	*$900,834,785*	*$466,123,431*	*$442,914,635*	*6,894*
Support activities for agriculture and forestry	$69,561,897	$67,508,555	$80,833,384	1,624
Electricity, water, sewage and other systems	$12,546,402	$7,157,610	$1,337,279	9
Fertilizer and pesticide manufacturing	$22,836,486	$6,098,362	$1,900,435	19
Fuel, oil, and transportation	$40,912,714	$14,312,677	$8,150,336	80
Wholesale, retail, warehousing and storage	$158,262,086	$100,481,627	$51,184,762	712
Financial and technical services	$107,242,435	$55,114,098	$29,962,423	269
Other real estate	$99,980,095	$50,978,160	$19,582,257	389
Legal and management services	$44,219,599	$31,332,317	$22,410,115	190
All Other	$377,207,194	$239,003,429	$127,524,540	1,949
Total	***$1,833,603,693***	***$1,038,110,265***	***$785,800,166***	***12,135***

Source: IMPLAN and WSU IMPACT.

A caveat must be noted regarding the job figures in the impact analysis. Job impacts are calculated by taking the income level and dividing those income levels by the average income per employee for each industry. Often those impacts are accurate in terms of the total number of jobs at risk. However, they may be thought of as full-time equivalent jobs and are not necessarily actual numbers of employees.

4. Potato Processing and Avoiding Double Counting

Potato Processing represents a significant value-added manufacturing segment of the Washington food supply chain. Those processors take the raw potatoes and transforms them into a highly desirable consumer product. Restaurants, sporting venues, and theme parks all over the world send money to Washington for those processed potatoes. Processing exports out of Washington totaled an estimated $3.46 billion in 2022.[5]

In order to capture the backward links of the processing supply chain we need to modify our model *to ensure there is no double counting of the potatoes themselves or the associated production supply chain*. This is done as described above, by severing the transactions between the processors and growers. This is done on the assumption that the processors exist locally because of the abundance of local supply. Value added processing in this industry needs to locate close to its input supply. This is fundamentally different from grain production where processing typically needs to by close to its consumer base.

Table 4.1 shows a percentage breakdown of the 2022 production and processing values. Because potato manufacturing enterprise budgets are closely held, expenditure patterns for the processors are based on national values that are regionalized to Washington state. Thus, a transformation of the potato processing system from enterprise spending to I-O spending is not needed as the conventional vegetable processing segment is the only available structure.

Table 4.1: *Percent Value of Output by Product Type*

	Potato Production	Potato Processing
Fresh Pack	10.5%	6.7%
Dehydrated	6.3%	4.8%
Frozen	80.5%	75.4%
Chips	2.7%	13.0%
Other Processed	0.0%	0.1%
Total	***100%***	***100%***

Source: WSU TRC, WSU IMPACT, and Potato Disposition Report.

After removing the value of the raw potatoes exported, direct processing contributions amounted to just under $2.36 billion in net exports in 2022. This resulted in additional business-to-business transactions of just under $2.2 billion (not including raw potato purchases). Processor owners and employees created additional supply chain contributions of $1.0 billion. Total transactions in the state stemming from potato processing amounted to $6.4 billion. As stated above, sales transactions is not the preferred method for reporting contributions as that measure of activity tends to be volatile and includes double counting of values. GSP, or value added, is the preferred measure of economic activity. Direct processing contributions from a GSP standpoint were roughly 37% of total processing exports at $883.80 million. Total contribution, after accounting for supply chain effects, were $2.58 billion. Those dollars supported 19,477 jobs and $1.44 billion in family income throughout the state.

[5] This value is estimated based on transportation export volume data and the potato disposition reports for Washington.

Table 4.2: *Processing Contributions Net of Potato Production*

Contributions Type	Sales	GSP	Income	Jobs
Direct	$2,359,633,063	$883,799,904	$400,537,708	5,797
Indirect	$2,142,313,133	$1,060,922,327	$696,638,200	8,855
Induced	$1,017,616,808	$639,642,977	$340,579,317	4,825
Total	**$5,519,563,004**	**$2,584,365,207**	**$1,437,755,224**	**19,477**

Source: WSU IMPACT

Processors add a significant value to the potatoes before they are exported from the state by converting them into the form most desired by full service and quick service restaurants. This process is referred to by economists as transformation arbitrage. The average industry in Washington generates roughly 11 cents per dollar on either physical, spatial or temporal arbitrage. Potato processors generate roughly 15 cents per dollar, making them more valuable to the state on average by bringing more money into the state.

5. Fiscal Impact

It is common to believe that after accounting for subsidies, tax preferences, and other fiscal exemptions, farmers pay drastically low taxes. However, there is a clear correlation between productivity and tax generation. Even non-profit entities, that pay no direct taxes, such as schools and churches, drive economic activity and transactions. Agricultural production and processing are no different. They increase income and spending, which result in increased revenue generation for state activities. This section of the report outlines the revenues to state and local governments due to the agricultural production and processing of potatoes alone.

While Washington does not have an income tax, incomes directly translate into increased sales and purchases of higher valued property assets, not to mention the property taxes of the business themselves. The tax revenues in Table 5.1 include business and household tax receipts received by the State, Counties, and Sub-County taxing authorities in Washington. These revenues are included as part of Gross State Product and cannot be added to the totals reported in the previous sections.

Table 5.1: *State and Local Tax Revenue Losses*

Property	$69,101,858
Sales and Excise	$147,313,843
Corporate and Other	$38,255,656
Total	***$254,671,357***

Source: IMPLAN and WSU IMPACT.

While already included in GDP, these tax revenues become income to the state and local governments that spend them to provide goods and services. Potato producers do receive some tax preferences, however, the associated tax generation from those preferences are substantial. Without potato production, associated processing would likely leave the state and government coffers would lose more than a quarter of a billion dollars. In order to continue providing the services funded by those dollars, local taxing districts would need to raise tax rates and increase the tax burden on others.

The Washington Potato sector pays an effective tax rate of just over 7.0%, i.e., $254.7 million in taxes divided by $3,622.5 million in GSP.[6] While this may look small at first it constitutes 111% of the state's average effective tax rate. Washington's annual tax receipts in 2022 were $42.8 billion while total GSP for that year was $676.5 billion. Giving the state an effective tax rate of just 6.3%.

[6] These measures are inclusive of the multiplier effects for both GSP and Taxes.

6. Growth through 2022

The last full economic analysis of the Washington Potato Sector conducted by WSU was conducted on the 2015 harvest and released in 2016. This section discusses some of the evolution of the sector over the past several decades including the real change in economic contributions. While the dollar amounts can be adjusted for inflation, a large factor in the market is the technological change, including the local vs. non-local supply chains. These changes result in alterations to the multipliers i.e., how long dollars brought into the economy, stay in the economy before exiting for the purchase of imports.

The contributions of potatoes from 2005, 2015, and 2022 are provided below in nominal in Table 6.1. These values are derived from past contribution reports. Unfortunately, not all past reports provided the GSP detail, so we were forced to compare the sales figures over the associated time horizon.

Table 6.1: *Nominal Contributions of the Washington State Potato Sector*

	2006	2015*	2022
Contributions	**Sales**	**Sales**	**Sales**
Direct	$1,755,503,537	$2,105,410,000	$3,236,536,783
Indirect	$1,297,175,752	$1,790,656,247	$2,577,744,396
Induced	$424,320,461	$1,356,432,543	$1,538,885,518
Total	**$3,476,999,750**	**$5,252,498,790**	**$7,353,166,697**

* The 2015 report did not reflect current methodological standards in Input-Output Analysis and were revised to reflect the more current and accurate standards.

Contributions are converted to 2023 dollars in Table 6.2 to make inflation adjusted comparisons. The annualized CPI for all goods in U.S. cities was used for the conversion to real dollar terms and the base year was converted from 1983 to 2023. The impacts of the 2022 potato crop and associated processing contributions grew 14.8% in real terms over the last 7 years. Most of this growth in value was realized in the processing segment as the value of potato production has remained relatively static for farmers. A 2.1% annualized growth rate is on par with national growth rates and likely higher than it is for other commodity sectors.

Table 6.2: *Real Contributions of the Washington State Potato Sector (2023 dollars)*

	2006	2015	2022
Contributions	**Sales**	**Sales**	**Sales**
Direct	$2,548,553,911	$2,566,897,415	$3,236,536,783
Indirect	$1,883,176,118	$2,183,152,399	$2,577,744,396
Induced	$616,007,628	$1,653,750,665	$1,538,885,518
Total	**$5,047,737,657**	**$6,403,800,479**	**$7,353,166,697**

7. Conclusions

Washington continues to be a leader in national potato production and is the U.S. leader in potato processing. Washington has one of the most efficient levels of potato production nationally as measured by yields. Since 2015 the value of the potato sector has grown by 14.8% and it contributes **more than $3.6 billion dollars to Washington's gross state product**. Of that $3.6 billion, nearly $255 million went to governments in the form of property, sales and excise, or other taxes. The Washington Potato sector paid an effective tax rate of just over 7.0%, considerably higher than the state's overall effective tax rate of just 6.3%. Potato production and processing **directly supported 12,508 jobs** within the state and **an additional 19,105 jobs throughout the sector's in-state supply chain**. In total the potato sector is responsible for **$2.2 billion in household income** that supports a total of 31,613 jobs in Washington.

Table 7.1: *2022 Summary Contributions of the Washington State Potato Sector*

Contributions Type	Sales	GDP	Income	Jobs
Direct	$3,236,536,783	$1,337,540,565	$831,686,125	12,508
Indirect	$2,577,744,396	$1,317,685,694	$876,787,583	11,804
Induced	$1,538,885,518	$967,249,213	$515,081,682	7,301
Total	**$7,353,166,697**	**$3,622,475,471**	**$2,223,555,389**	**31,613**

Source: WSU IMPACT Center

78% of the revenue coming into Washington as a result of potato exports, stems from Asia, the majority of which derives from Japan, South Korea, and Taiwan. North America, mostly other U.S. States, capture only 12% of Washington potato exports. Potatoes remain a primary commodity for the state and are a large value-added crop with deep value-added components domestically. This is juxtaposed with our grain and forage crops that are largely exported before processing takes place. While the backward links of potato production are similar to other row crops, the forward links with processors make the commodity particularly valuable for the state in terms of both dollars and jobs.

References

Cabrera,V.E., D. Hagevoort, R. Solı´s, R. Kirksey, and J. A. Diemer. 2007. "Economic Impact of Milk Production in the State of New Mexico." J. Dairy Science, 91: 2144-2150.

Galinato, S. and. 2020. 2019 Costs Estimates of Producing Fresh and Processing Potatoes in Washington. Washington State University Extension Publication TB67E. http://ses.wsu.edu/wp-content/uploads/2020/06/TB67E.pdf

Galinato, S. and Peter Tozer 2016 The Economic Contributions of the Potato Industry in Washington State.

IMPLAN Group. 2019. IMPLAN Pro: Margining When the Item Being Purchased is Known. https://implanhelp.zendesk.com/hc/en-us/articles/115009542207-IMPLAN-Pro-Margining-When-the-Item-Being-Purchased-is-Known

KOMO News. 2020. Washington farmers to give away 200,000 pounds of potatoes at the Tacoma Dome (13 May 2020). https://komonews.com/news/local/washington-farmers-to-give-away-200000-pounds-of-potatoes-at-the-tacoma-dome

NPD Group, Inc. 2020. Custom Data Request. 900 West Shore Road, Port Washington, NY 11050

Ryder, D. and C. Walljasper. 2020. The great potato giveaway: U.S. farmers hand out spuds to avoid food waste. Reuters Business News (7 May 2020). https://www.reuters.com/article/us-health-coronavirus-food/the-great-potato-giveaway-u-s-farmers-hand-out-spuds-to-avoid-food-waste-idUSKBN22J3J6

Steinback, S.R. 2004. "Using Ready-Made Regional Input-Output Models to Estimate Backward-Linkage Effects of Exogenous Output Shocks." The Review of Regional Studies, Vol. 34, No. 1, pp. 57-71.

USA Trade Online. 2019. State Export Data (Origin of Movement) Harmonized Schedule. Washington, D.C.: United States Census Bureau.

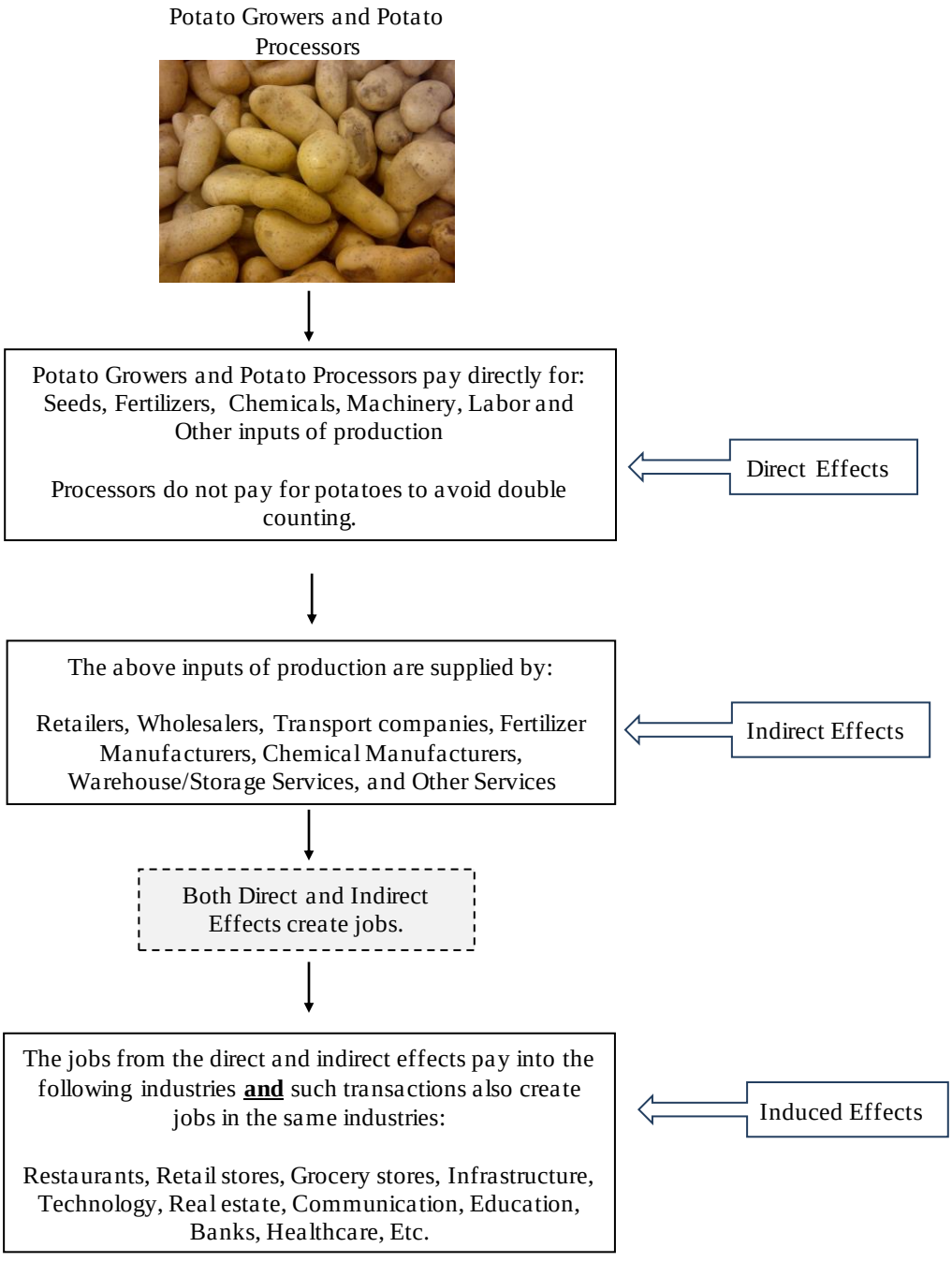
USDA NASS (National Agricultural Statistics Service) Quick Stats. 2019. Statistics by Subject: Crops and Plants. Washington, D.C.: NASS, United States Department of Agriculture.

Watson, P., J. Wilson, D. Thilmany, and S. Winter. 2007. "Determining Economic Contributions and Impacts: What is the difference and why do we care?" Journal of Regional Analysis and Policy, 37(2): 140-146.

Willis, D. and D. Holland. 1995. "Translating Farm Enterprise Budgets Into Input-Output Accounts: Another Example from Washington State." WSU Agricultural Economics Publication No. A.E. 97-1

Appendix 1: Economic Multipliers

Potato Industry Activities Captured by the Input-Output Model



Appendix 2: Basics of Input-Output Models

The Basic Input-Output model

The system of accounts known as Input-Output (I-O) represents an economist's version of double-entry book keeping for industries. Figure A.2 below shows a simplified version of an I-O matrix with just a hand full of industries.

Figure A.2: Aggregated form Input-Output Matrix

		Producers as Consumers						**Final Demand**			
		Agric.	Min.	Const.	Manuf.	Services	Other	Households	Investment	Government	Net exports
Producers	Agric.										
	Min.										
	Const.										
	Manuf.										
	Services										
	Other										
Value Added	Labor							Gross Domestic Product			
	Returns to Capital										
	Taxes										

Reading down a column of this table shows you what inputs an industry is buying in order to produce their output. If we look at the Agriculture column, they may buy seed from themselves, fertilizer and farm equipment from the manufacturing sector, and legal and accounting services from the service sector. Payments to their employees are captured in the "Labor" row, they receive the returns to the capital that they own, and they pay taxes to the government. Reading across a row tells us where an industry's income originates. Sticking with agriculture, they sell seed to others in the agricultural sector; their crops may be sold to processing plants in the manufacturing sector, or perhaps directly to consumers. A portion of a household's expenditures will go to buying agricultural goods, and even government may purchase agricultural goods. Lastly, the agricultural industry will sell its output abroad via the "Net exports" column. Summing all the labor, capital, and tax payments for all industries gives the sum of all value added and will equal the Gross Domestic Product (GDP) of the region. Similarly summing all the expenditures of households, government, investment, and net exports yields the GDP of the region. These two methods of calculating GDP are known as the Income and Expenditure approaches, respectively, and they represent a check for ensuring all accounts balance. It is through the I-O system that we are able to trace the dollars through the economy and calculate multiplier effects.